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Biological Survey of the South Branch of the Dead River

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Caring for Maine's Outdoor Future

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Division of Fisheries & Wildlife

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BIOLOGICAL SURVEY OF THE SOUTH BRANCH OF THE DEAD RIVER

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SOUTH BRANCH OF THE DEAD RIVER SURVEY

INTERIM SUMMARY REPORT NO. 1 (2003)

SUMMARY

The South Branch of the Dead River, a tributary to the Kennebec River drainage in Western Maine, provides habitat for indigenous brook trout (*Salvelinus fontinalis*) and wild landlocked salmon (*Salmo salar)*. The Department of Inland Fisheries and Wildlife surveyed the South Branch in 2003 assisted by volunteers from the Rangeley Region Guides' and Sportsmen's Association, the Isaac Walton League of America, and several individuals. We conducted a complete biological survey of fisheries habitat, which allowed quantification of the river's value as fishery habitat. River morphology was impacted in the early 20th Century by log driving and much of the river remains degraded. Water quality is suitable for salmon and brook trout except that water temperatures exceed thermal tolerances for both species during summer months. The total area of the South Branch of the Dead River is 1,839 acres of which 43 acres (2.3 %) are pools. Ninety-three percent of the river's area was classified as good to excellent for adult brook trout habitat; 50% was classified as good to excellent for juvenile brook trout habitat. Spawning gravel was distributed over much of the river from mile 4.5 to mile 19[1].

We also classified the river morphology, which allowed us to determine the condition or state of the river. Fifty percent of the river's length was type F (degraded; entrenched and unstable); 30% was type B (riffles/rapids and step pools); 14% was type C (riffles and pools); and 1 % was type E (low gradient, winding 'deadwater'). Fifty-three percent of the river's area was classified as highly sensitive to disturbance, including stream bank erosion potential and sedimentation supply. Warm summer water temperatures and a lack of deep pools are the limiting factors for brook trout in the South Branch of the Dead River. In addition to salmon and brook trout, the surveyed lakes, ponds, and streams of the drainage include suckers, sculpin, and 9 species of minnows .

KEY WORDS: HABITAT EVALUATION, STREAM, WATER QUALITY

[1] River miles are measured from the river's mouth.

INTRODUCTION

The South Branch of the Dead River is relatively undeveloped except that it has a long history of timber harvesting and log driving, as evidenced by the remains of several log driving dams. Sections of it parallel Rt. 16 and the Redington Road. The objectives of the river survey conducted in 2003 were to determine the quantity and quality of fisheries habitat for different life stages of brook trout and to determine the state or condition of the river. Results of this and other river surveys will be used to evaluate habitat quality and refine statewide salmonid abundance estimates.

DESCRIPTION OF THE DRAINAGE

General

The South Branch of the Dead River, located in Franklin County, originates at Saddleback Lake. It flows northward to Flagstaff Lake near the confluence of the North Branch. The South Branch of the Dead River has a drainage area of 144 square miles. It is 23.5 miles long from its origin at Saddleback Lake to its mouth at Flagstaff Lake.

River sinuosity (the ratio of the channel length to the valley length) is 1.77[2]. The entire river drops in elevation from 1,747 feet at its origin at Saddleback Lake to 1,146 at Flagstaff Lake, for a total of 601 feet or 25.6 feet per mile and an average slope of 0.48% (Figure 1). The South Branch of the Dead River lies within the townships of Dallas Plt., Lang Twp., Coplin Plt., and Eustis.

The watershed is hilly and forested with spruce-fir and areas of mixed hardwoods. The steepest river gradient is between Saddleback Lake and the Redington Road (river miles 22.6 to 22.2) with shorter reaches of quickwater at Fansanger Falls (river mile 16.8) and the Barn Doors (river mile 2.2). The drainage has several great ponds[3]; the largest is Saddleback Lake, which is 358 acres in size (Table 1). Twenty-one named tributary streams total 54.8 miles in length

[2] Stream length of 23.5 miles divided by valley length (straight-line distance between head and mouth of river).
[3] Inland bodies of water which in a natural state have a surface area in excess of 10 acres.

(Table 2); none has been extensively surveyed. The combined lengths of the tributaries' stream channels is 2.3 times that of the main stem.

The primary land use within the drainage is forestry. Route 16 and a network of gravel logging roads provides access to much of the river. A series of mountains and ridges separates the drainage from the Kennebago River to the west and the Sandy River to the east. Six mountain peaks within the drainage, the highest of which is Saddleback Mountain, are over 3,000 feet in elevation. There is an elevation difference of 2,910 feet between the highest and lowest points within the drainage.

HISTORY OF USE

Land and Water Development

Logs and pulpwood were driven down the South Branch of the Dead River and a number of dams were built to facilitate the drives. There is imperfect information about the location of these dams. There was one at the outlet of Saddleback Lake, reportedly one below the confluence of Cold Brook (no remains survive), then Flagg Dam (river mile 20.5). There was also a dam at Langtown Mill (river mile 13.4) and Buxton Dam (approximate river mile 4.0) was upstream of the Eustis town line.

Regional files document bulldozing of the South Branch in 1955 to facilitate log driving. In this instance, investigated by fishery biologist Carll Fenderson, a total of 1,969 feet of river were bulldozed at two sites in Lang Twp. According to the memo documenting this activity, "(t)he river bed has been completely scooped out and piled back on the banks, in most places to a height of 8-12 feet. The old river banks have been obliterated and all shade and hiding places for fish removed. In addition to the bulldozing in the main channel, a crew of men and horses have been plugging the logans and backwater areas with stones and debris to prevent pulp loss. The South Branch of the Dead River has produced excellent brook trout fishing this year. The recent bulldozing has completely destroyed one of the best fishing and most productive sections of the river. Continued bulldozing in other sections of the South Branch plus bulldozing carried out in past years (still very much in evidence) will have a pronounced effect upon the sport fishery of the Dead River for many years to come."

Fisheries Management History

Loon Lake was first surveyed in 1951, Saddleback Lake in 1953, Redington Pond in 1958, Cow Pond in 1964, and the Greely Ponds in 1975. At the time of the lake surveys, tributaries were surveyed in a cursory way to determine their value as fisheries spawning and nursery habitat. Although most of the lakes within the drainage have been surveyed, no detailed fisheries management work, including electrofishing, has been done on the streams within the drainage. Landlocked salmon and brook trout are stocked in Loon Lake and brook trout are stocked in Saddleback Lake and Little Greely Pond. The main stem of the South Branch has been stocked with spring yearling brook trout since 1978 and with fall yearling brook trout since 2003. The river is open to general-law fishing except that the section between the Route 16 bridge in Dallas Plantation to the Langtown Mill bridge remains open to fishing through October. During that period fishing is restricted to the use of artificial lures and all fish must be released alive.

Obstructions

Since the deterioration of the log driving dams, fish have unobstructed movement throughout the main stem of the South Branch of the Dead River from Flagstaff Lake to Saddleback Lake. There is a dam on the outlet of Saddleback Lake that was last rebuilt in 1982 and is impassable to the upstream movement of fish. The remains of the old log-driving dams do not pose barriers to fish migration. Although there are other natural cascades and rapids on the South Branch of the Dead River, they are passable to salmonid migration in both directions.

Water Quality and Pollution

Other than logging and remote recreation, there has been little cultural development of the river. Water quality is designated Class A by the Maine Department of Environmental Protection (DEP), the second highest rating given for fresh surface waters. Waters of this class are suitable for recreational purposes and for public water supplies after disinfection.

Land use regulations within much of the drainage are administered by the Maine Land Use Regulation Commission (LURC). Riparian zones were established to "maintain water quality, plant, fish and wildlife habitat and in order to protect and enhance scenic and recreational

opportunities". P-SL1 subdistricts apply within 250 feet of the normal high water mark of flowing waters downstream from the point where such waters drain 50 square miles or more. P-SL2 subdistricts apply within 75 feet of the normal high water marks of stream channels upstream from the point where such channels drain 50 square miles. Clearcutting within P-SL1 zones is prohibited within 50 feet of normal high water and harvesting activities must result in the retention of a well-distributed stand of trees. Beyond the 50-foot distance, additional restrictions limit the size of canopy openings and volume removal. Within P-SL2 Protection Subdivisions, two sets of standards apply. Upstream of the point where they drain 300 acres or less, standards intended to prevent erosion and siltation apply. Downstream of this point, harvesting must meet the above standards and maintain shading of the surface waters. The main stem of the river to a point upstream of river mile 14.5 is zoned as P-SL2; from thereon downstream, it is zoned P-SL1. Tributaries are zoned P-SL2.

HABITAT QUANTITY AND QUALITY

Water quality

Season-long water temperatures were continuously recorded at the upper (Flagg Dam, mile 20.5), mid (Fansanger Falls, mile 16.9), and lower (Kennebago Settlement Road bridge, mile 7.6) sections of the river, as well as lower Nash Stream, from late May to early September, 2003 (Table 3). Following several years of moderate drought, 2003 was wet with unusually high water levels in the fall. Monthly averages indicated that the warmest temperatures, in the high 70's on the main stem and in lower Nash Stream, occurred over a prolonged period, from June through August, indicating that the main stem has limited value as brook trout habitat during this period. Hourly water temperature readings frequently exceeded 68°F, particularly in the lower half of the river (Table 4). Water temperatures in the main stem of the river were at or exceeded 77°F (the lethal temperature for brook trout) several days in 2003, and it is likely that brook trout would be forced to locate thermal refugia during these periods. Temperatures at the lower site on the main stem of the river averaged 3-4 degrees warmer than those at the upper site.

Water quality analyses of the South Branch of the Dead River and tributaries, conducted during the summer of 2003 (Tables 5 and 6), indicated that water quality parameters other than

temperature, including levels of oxygen and pH, are ideal for brook trout. Alkalinity and conductivity values were typical for Maine waters. These readings, taken in August, confirmed that water temperatures are the limiting factor for coldwater fish. Even the upper river had high water temperatures, probably influenced by the warmwater discharge from Saddleback Lake. With the exception of Nash Stream, tributary water temperatures were suitable for brook trout and they probably move to these thermal refuges in summer months.

Habitat Survey

During the summer of 2003, the South Branch of the Dead River was systematically surveyed to document the location, type, quality, and abundance of fisheries habitat and to evaluate the physical stability of representative river reaches. Prior to the survey, the river was divided into 13 survey sections – identified on maps and on the ground - with the intent that one section would be completed by one survey crew in one day. Fishery Division staff and volunteers surveyed the river by foot and by canoe at an average rate of 1.3 miles per day per team (Table 7; Appendix 1). Three survey crews were deployed per day, and the 23 miles of the South Branch of the Dead River was surveyed in three calendar days by a total of 32 individuals. Information was summarized from data recorded at transects between the headwaters at Saddleback Lake and Flagstaff Lake. Transects were generally spaced from 150 to 1,100 feet apart depending on the uniformity of the habitat. The lower end of the surveyed section (at Flagstaff Lake) was designated as River Survey Mile 0 and distances were referenced to this point.

Fisheries habitat was quantified using habitat suitability index models for brook trout (Raleigh 1982). Habitat requirements and preferences were converted to numeric values ranging from 0 (unsuitable habitat) to 1 (optimal habitat), where an overall value of 0.5 is considered to be average habitat. Variables measured included water depth, cover, pool class, substrates size and type, and shade. Juvenile and adult habitat were rated separately, because these life stages have different habitat requirements. Spawning habitat was not rated. Rather, sites with substrate suitable as salmonid spawning habitat (gravel and smaller pea gravel) were mapped as potential spawning areas.

River reaches were also categorized using the Rosgen Classification System, a method of classifying stream channel reaches based on measurable morphological characteristics (Appendices 2 & 3). For this report, the river was classified to determine its broad morphological characterization (Level I) and description (Level II). Such classification is a necessary precursor to stream condition assessment (Level III) and verification (Level IV) (Rosgen 1996). With the exceptions of data collected at the reference sites, both the Level I and Level II assessments were established from a minimum of criteria and are subject to refinement; however, they are assumed to describe the river accurately in general terms.

Level I analysis, which can be determined from a combination of maps, aerial photographs, and field measurements, results in broad categories (lettered from A through G) that describe the stream's slope, sinuosity, entrenchment, and width/depth ratio (ratio of bankful width/mean bankful depth). As an example, Class C describes a winding reach of stream characterized by riffles, pools, and point bars. Level II stream classification adds a numeric substrate descriptor, graduated in size from bedrock (1) to silt (6). Additional Level II criteria, which were employed only at the reference sites, include entrenchment ratio (width of the flood prone area at an elevation twice the maximum bankful depth/bankful width), sinuosity (stream length/valley length), and meander width ratio. Measurements were taken to determine Level II stream type at several additional sites. Using this method, a total of 12.0 miles of the river as designated as Class F; 6.7 miles as Class B; and 2.8 miles as Class C, and 1.2 miles as Class E (Table 8). Transitions between reaches were identified by GPS (Table 9).

Length and width measurements indicated a total of 1,839 acres of habitat (stream area) in the South Branch of the Dead River (Table 10). The average width of the river increased from 23 feet below Saddleback Lake to 118 feet above Flagstaff Lake. The average depth increased from 0.7 feet to 1.5 feet. F reaches (entrenched, degraded, unstable riffle and pool) accounted for 50% of the length; Bc (riffle, step pools) accounted for 30%; C reaches (riffle and pool) accounted for 14%; and E (low gradient, meandering) accounted for the remaining 6% (Table 11). Cascades were present but accounted for a very small portion of the total river length. Riffles and runs, which provide important spawning and nursery habitat for both salmon and brook trout, accounted for nearly 90% of the total area (Table 12). The most common stream classes were Class F (entrenched, unstable, degraded reaches, typified by riffles and pools),

which accounted for 53% of the river's length; and Class B (rapids), which comprised 30% of the total length. The long Class F reach begins at the channelized area and extends downstream for a number of miles. The extent of the degradation probably results from the bulldozing, the driving dams, or from a combination of the two.

There was a total of 94 discrete pools, accounting for 43.3 acres, or 2.4% of the classified area (Appendix 5). Of the pool area, 47% was Class A (defined in Appendix 4), indicating the largest, deepest class of pool which provides the best habitat for adult brook trout. The deepest pool recorded had a maximum depth of 18 feet. Class A pools averaged a maximum of 6.6 ft in depth; Class B averaged 3.4 ft, and Class C averaged 3.1 ft. Some smaller pools may have been omitted from counts, because they were sometimes difficult to define and/or denote. Distance between pools was greater than expected (Table 13), probably a result of degradation caused by log driving. Reaches 3 and 5 contained no pools. The lack of pools is significant from a fisheries standpoint because they provide important adult salmonid habitat. The depth provided by pools provides both cover and cool groundwater-inflow refuges during summer months. The loss of these pools, which is associated with stream degradation, reduces the river's carrying capacity for coldwater fish.

Overhead cover (shading provided by riparian trees and other vegetation) was measured as an indicator of protection from solar warming (Table 14). Shading from trees was most abundant in Reaches 1 and 2 (the uppermost part of the river) and least abundant in Reaches 7, 8, and 9, the lower part of the river. Shrubs and overhanging vegetation were more evenly dispersed throughout the river's length.

Habitat suitability indices indicated that above-average quality adult and juvenile brook trout habitat was present in all reaches (Table 15). Overall, 79% of the adult brook trout habitat and 52% of the juvenile brook trout habitat rated 0.6 or greater, with a rating of 0.5 being average. Adult and juvenile habitat, as well as spawning substrate, was spread throughout the length of the river, with the exception that Reaches 1 and 4 (deadwater habitat) contained little or no spawning substrate. Arranged by stream class, F4 accounted for a large area (53% of the total river) of mediocre adult brook trout habitat (Table 16). Classes B4, C3, and C4 accounted for the highest value adult brook trout habitat, but these classes – located in the upper portion of the river - comprised only 23% of the river's total area. Juvenile brook trout habitat varied widely in

quantity and quality throughout the river; however, the best habitat – as indicated by higher HSI values - tended to occur in the upper portion of the river (Table 17). For juveniles, the limiting factors are excessive depth, lack of cover, and/or high water velocity.

Substrate of suitable size for salmon and brook trout spawning (gravel and pea gravel) was concentrated in the lower river and noticeably absent between Saddleback Lake and the Redington Road (Table 18). However, adult brook trout migrate considerable distances to spawning habitat, so the lack of gravel in this reach is probably not a limiting factor. The proportion of the substrate actually used by brook trout and salmon remains to be determined, however.

Several methodologies are available to assess stream stability. Pfankuch ratings, which measure stream stability, indicate that the river is least stable in the lower sections (Table 19). Indicators of response to change (Rosgen 1996) reveal that a total of 65% of the river's area was considered to have very high to extreme sensitivity to disturbance; 61% had very high streambank erosion potential, and 58% had very high sediment supply (Table 20). Much of the lower river is still unstable and in transition nearly a half century after log driving was suspended.

SPECIES OCCURRENCE, ABUNDANCE, AND GROWTH

A total of 16 fish species, including brook trout and landlocked salmon, have been documented within the drainage (Table 21). Brook trout and blacknose dace (*Rhinichthys cataractae*) are the most widely distributed species throughout the drainage; Saddleback Lake and Loon Lake have the greatest species diversities of individual waters. The absence of species of the perch and sunfish families from the drainage greatly enhances its value as trout and salmon habitat[4]. A single chain pickerel (*Esox niger*) was captured in Saddleback lake in 1979 but none has been captured in subsequent nettings. Their current status is unknown. To date there have been no abundance estimates conducted on the main stem of the South Branch or its tributaries. There is a fishery for wild brook trout in the upper river and in its tributaries and there are seasonal runs of brook trout and salmon in the lower river from Flagstaff Lake. However, most

[4] Yellow perch and pickerel are present in Flagstaff Lake, but have not migrated up the river to date.

of the fishery relies on stocked brook trout. Spring and fall stockings are intended to provide seasonal fisheries when water temperatures are cool.

RECOMMENDATIONS

Electrofish representative reaches to determine species composition and abundance. Survey tributaries on a time-available basis. Maintain brook trout stocking at current rates. Incorporate the results of this survey into a statewide stream survey database.

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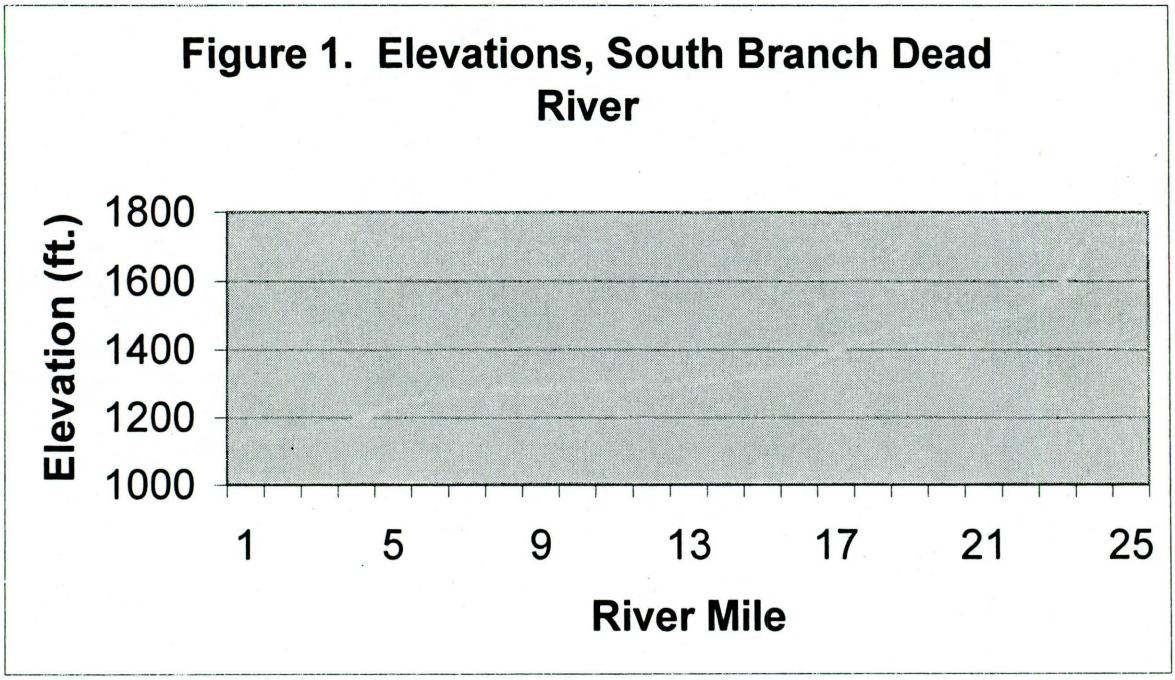

Table 1. Lakes and ponds within the South Branch of the Dead River drainage. Waters with missing information have not been surveyed.

Name	Town	Size (acres)	Maximum depth (feet)	Principal fisheries
Saddleback Lake	Dallas Plt.	358	14	Brook trout
Quill Pond	Dallas Plt.	6	.	.
Dill Pond	Dallas Plt.	11	.	.
Loon Lake	Dallas Plt., Rangeley	176	50	Salmon, brook trout
Cow Pond	Lang Twp.	62	6	Brook trout
Little Greely Pond	Dallas Plt.	15	12	Brook trout
Greely Pond	Dallas Plt.	42	2	None
Ben Gile Pond	Lang Twp.	5	.	.
Reed Pond	Eustis	10	.	.

Table 2. Length and area of South Branch of the Dead River and tributaries.

Name	Township	Length (mi)	Drainage area (mi^2)
Haley Brook	Dallas Plt., Sandy River Plt.	3.0	4.35
Rock Pond Stream	Dallas Plt., Sandy River Plt.	2.2	1.94
Geneva Bog Brook	Dallas Plt., Sandy River Plt.	1.6	1.63
Cold Stream	Dallas Plt.	3.4	3.48
Redington Stream	Dallas Plt., Redington	7.4	14.8
South Branch Dead R. at Rt. 16 bridge	Dallas Plt.	NA	**34.0**
Quill Pond Brook	Dallas Plt.	3.4	3.53
S. Branch Dead R. at Langtown bridge	Lang Twp.	NA	**55.2**
Baker Brook	Lang Twp.	4.5	5.84
Cherry Run	Coplin Plt., Eustis, Tim Pond	5.4	4.42
Lutton Brook	Eustis	6.3	8.65
Nash Stream	Coplin Plt., Redington	11.9	34.1
Reed (Cove) Brook	Eustis	4.5	4.17
South Branch Dead R. at mouth	Eustis	23.4	**144**

Table 3. Monthly averages of water temperatures (°F) recorded on the South Branch of the Dead River and Nash Stream, May 8 through September 9, 2003.

Site	Temperature variable	Month				
		May	June	July	Aug.	Sept.
Flagg Dam	Minimum	43	48	55	55	55
(River mile 20.5)	Maximum	64	77	72	73	61
	Mean	52	61	64	66	59
Fansanger Falls	Minimum	50	52	59	55	54
(River mile 16.9)	Maximum	57	79	77	79	70
	Mean	52	61	68	68	61
Kennebago Settlement	Minimum	43	50	58	56	57
Road bridge	Maximum	63	77	74	76	64
(River mile 7.6)	Mean	51	61	68	68	61
Nash Stream	Minimum	47	45	57	54	54
(Enters at river mile	Maximum	56	74	74	76	68
2.7 on S. Branch Dead)	Mean	50	57	64	65	60

Table 4. Average water temperatures (°F) recorded on the South Branch of the Dead River and Nash Stream, July and August only, 2003.

Site	River mile	Mean daily temperature	No. days where: Min. temperature >68° °F	Min. temperature >77°F	Mean temperature >68°F	Mean temperature >77°F	Max. temperature >68°F	Max. temperature >77°F
Flagg Dam	20.5	65	1	0	9	0	37	0
Dallas (Fansanger Falls)	16.9	68	9	0	32	0	53	3
Kennebago Settlement bridge	7.6	68	18	0	33	0	48	0
Nash Stream		64	0	0	2	0	47	0

Table 5. South Branch of the Dead River water quality.

Date	Location	River mile	Water temp. (°F)	Oxygen (mg/L)	pH	Alkalinity	Conductivity
8/7/03	Saddleback Lake Outlet	23.0	81	7.9	6.9	4	31
8/9/03	Redington Road	21.6	77	7.8	6.8	6	31
8/9/03	Camp Road	20.0	70	8.3	7.0	7	35
8/9/03	Greely P Rd bridge site	17.3	70	8.7	7.0	10	35
8/9/03	Dallas/Langtown line	15.7	73	7.9	7.0	7	36
8/9/03	Gravel pit bridge	14.4	75	7.8	7.0	7	38
8/9/03	Langtown Mill bridge	13.3	75	7.9	7.0	.	38
8/9/03	Upstream of oxbow	11.2	73	8.2	7.0	.	42
8/7/03	Howatt trail	9.1	73	8.5	7.0	7	48
8/7/03	Kennebago Setlmnt bridge	7.7	72	8.6	7.0	9	48
8/7/03	Bourque Road	6.2	73	8.7	7.1	11	50
8/7/03	Barn Doors	2.3	72	8.7	7.2	9	38

Table 6. Water quality, South Branch of the Dead River tributaries, sampled August 7-9, 2003.

Name	Location	S. Br. Dead River mile	Water temperature (°F)	Oxygen (mg/L)	pH	Alkalinity	Conductivity
Cold Stream	Near mouth	21.7	.	7.5	6.9	5	34
Redington Stream	Redington Road	20.6	66	8.6	7.0	7	43
Quill Pond Brook	Near mouth	16.0	64	8.4	6.8	5	48
Baker Brook	Near mouth	13.3	66	7.7	6.9	.	58
Lutton Brook	IP road bridge	3.2	68	7.3	7.3	18	63
Nash Stream	Near mouth	2.4	72	8.5	7.1	7	31
Nash Stream	Rt. 16 bridge	2.4	72	8.5	7.0	6	30
Reed (Cove) Brk	IP road bridge	0.5	63	9.1	7.3	25	81

Table 7. **Survey** sections, South Branch of the Dead River survey, 2003.

Date	Survey section number	Section description	Distance feet	Distance miles	No. of transects	River miles
		Lake influence		0.5		22.4-22.9
7/28/03	1	Saddleback lake to Redington Road	7,980	1.5	16	20.9-22.4
7/28/03	2	Redington Road to Rt. 16 bridge	11,250	2.1	33	18.8-20.9
7/28/03	3	Rt. 16 to Greely P bridge site	10,290	1.9	25	16.9-18.8
7/28/03	4	Greely P bridge site to Lang Twp. line	8,319	1.6	15	15.3-16.9
7/29/03	5	Lang Twp. line to gravel pit rd. bridge	7,161	1.4	14	13.9-15.3
7/29/03	6	Gravel pit rd. br to Langtown Mill br	6,281	1.2	14	12.7-13.9
7/29/03	7	Langtown bridge to oxbow	9,670	1.8	17	10.9-12.7
7/29/03	8	Oxbow to Howatt trail	8,850	1.7	17	9.2-10.9
7/30/03	9	Howatt trail to Kennebago Settlement br	7,800	1.5	14	7.7-9.2
7/30/03	10	Kennebago Sett br to Bourque Rd	8,500	1.6	18	6.1-7.7
9/9/03	11	Bourque Rd to Lutton Brook	15,225	2.9	18	3.2-6.1
7/30/03	12	Lutton Brk to Barn Doors	5,063	1.0	10	2.2-3.2
7/30/03	13	Barn Doors to mouth	8,820	1.7	13	0.5-2.2
		Lake influence		0.5		0-0.5
	All		**115,209**	**22.9**		

Table 8. South Branch of the Dead River stream types by **Reach**. Distances in feet unless otherwise noted.

Reach	Transect numbers	River mile	Length	Elevation	Change in elevation	Slope	Sinuosity	Stream class
Lake influence		23.2-23.5	1,584	1,742-1,742	0	0		
1	1-6	22.7-23.2	2,640	1,720-1,742	22	0.0080	1.08	C4
2	7-11	22.2-22.7	2,640	1,600-1,720	120	0.0455	1.08	B4
3	12-16	21.7-22.2	2,640	1,520-1,600	80	0.0303	1.06	C3
4	17-37	20.5-21.7	6,336	1,500-1,520	20	0.0032	1.55	E5
5	38-47	19.8-20.5	3,696	1,490-1,500	10	0.0027	1.13	F6
6	48-69	18.0-19.8	9,500	1,475-1,490	15	0.0016	1.42	C4
7	70-117	13.5-18.0	23,760	1,315-1,475	160	0.0067	1.10	B4
8	118-210	2.2-13.5	59,664	1,175-1,315	140	0.0023	1.65	F4
9	211-223	0.5-2.2	8,976	1,146-1,175	29	0.0032	1.71	B4
Lake influence		0-0.5	2,640	1,146-1,146	0	0		

Table 9. Reach locations (UTM Zone 19 NAD 27 Conus), South Branch of the Dead River.

Reach	Stream class	Upper end UTMX	Upper end UTMY	Lower end UTMX	Lower end UTMY
1	C4	190377177E	4981579N	190377471E	4981744N
2	B4	190377471E	4981744N	190377512E	4981768N
3	C3	190377512E	4981768N	190378337E	4983050N
4	E5	190378337E	4983050N	190377000E	4983837N
5	F6	190377000E	4983837N	190376078E	4984135N
6	C5	190376078E	4984135N	190374468E	4985170N
7	B4	190374468E	4985170N	190375761E	4991075N
8	F4	190375761E	4991075N	190384158E	4999171N
9	B4	190384158E	4999171N	190384599E	5001043N

Table 10. South Branch of the Dead River area by reach.

Reach	No. survey sections	Length (ft)	Mean width (ft)	Mean depth (ft)	Surface area ft.²	Surface area 100 yd.²	Surface area Acres	Stream class
1	10	5,155	22.7	0.71	865,236	961	19.9	C4
2	5	2,875	27.8	1.19	912,250	1,014	20.9	B4
3	5	2,213	32.9	0.68	696,920	774	16.0	C3
4	21	6,500	35.5	1.99	2,416,750	2,685	55.5	E5
5	10	3,800	55.8	2.17	2,159,400	2,399	49.6	F6
6	22	9,320	40.7	1.73	4,254,503	4,727	97.7	C5
7	48	23,266	62.6	1.17	16,116,567	17,907	370.0	B4
8	94	54,752	72.0	1.65	42,317,420	47,019	971.5	F4
9	13	8,820	118.2	1.50	10,348,050	11,498	237.6	B4
All	**228**	**116,701**			**80,087,096**	**88,984**	**1,838.7**	

Table 11. Summary of stream types.

Stream class	Length feet	Length miles	Percent of total
B4	34,961	6.62	30.0
C3	2,213	0.42	1.9
C4	5,155	0.98	4.4
C5	9,320	1.77	8.0
E5	6,500	1.23	5.6
F4	54,752	10.37	46.9
F6	3,800	0.72	3.3
All	**116,701**	**22.11**	**100.1**

Table 12. South Branch of the Dead River run types. Measurements in ft.²

Reach	Stream type	Length (ft.)	Characteristic	Area	Percent of: reach	Percent of: total
1	C4		Cascade	26,700	40.4	0.4
			Low gradient riffle	39,374	59.6	0.5
			All	**66,074**		**0.9**
2	B4		Cascade	41,125	54.8	0.5
			Low gradient riffle	33,900	45.2	0.5
			All	**75,025**		**1.0**
3	C3		Low gradient riffle	64,456	92.5	0.8
			Run	5,236	7.5	0.1
			All	**69,692**		**0.9**
4	E5		Deadwater	57,325	23.7	0.8
			Low gradient riffle	45,760	18.9	0.6
			Run	138,590	57.3	1.8
			All	**241,675**		**3.2**
5	F6		Deadwater	34,600	16.0	0.5
			Low gradient riffle	45,870	21.2	0.6
			Run	135,470	62.7	1.8
			All	**215,940**		**2.9**
6	C5		Low gradient riffle	50,145	13.4	0.7
			Run	322,750	86.6	4.3
			All	**372,895**		**5.0**
7	B4		Cascade	36,778	2.5	0.5
			Deadwater	56,904	3.9	0.8
			Low gradient riffle	583,173	40.3	7.8
			Pool	131,270	9.1	1.8
			Rapids	29,470	2.0	0.4
			Run	609,792	42.1	8.1
			All	**1,447,387**		**19.3**
8	F4		Deadwater	39,974	1.0	0.5
			Low gradient riffle	1,599,349	39.0	21.3
			Pool	264,482	6.5	3.5
			Run	2,186,798	53.5	29.2
			All	**4,090,603**		**54.5**
9	B4		Low gradient riffle	599,030	65.1	8.0
			Pool	66,230	7.2	0.9
			Run	255,045	27.7	3.4
			All	**920,305**		**12.3**

Table 12. South Branch of the Dead River run types. Measurements in ft.² (con't.).

Reach	Stream type	Length (ft.)	Characteristic	Area	Percent of: reach	Percent of: total
All	**All**		**Cascade**	**104,603**		**1.4**
			Deadwater	**188,803**		**2.5**
			Low gradient riffle	**3,061,057**		**40.8**
			Pool	**461,982**		**6.2**
			Rapids	**29,470**		**0.4**
			Run	**3,653,681**		**48.7**
			All	**7,499,596**		**100.0**

Table 13. Pool frequency, South Branch of the Dead River. Distances in feet.

Reach	Rosgen class	Number of pools	Stream length	Distance between pools	Bankfull widths between pools observed	Bankfull widths between pools expected
1	C4	7	2,892	413	18	5-7
2	B4	4	2,875	719	26	4-5
3	C3	0	2,213			5-7
4	E5	1	6,500	6,500	183	
5	F6	0	3,800			
6	C4	18	9,320	518	13	5-7
7	B4	30	23,266	776	13	4-5
8	F4	29	54,752	1,888	26	
9	B4	5	8,820	1,764	15	4-5

Table 14. Cover, South Branch of the Dead River, by reach.

Reach	Percent overhead cover[5] Shade	Shrub	Overhang
1	32	27	1.8
2	32	17	0.8
3	10	60	.
4	0	66	3.9
5	0	65	.
6	14	23	5.6
7	6	29	1.1
8	4	48	1.8
9	2	12	0.02

[5] Shade cover refers to the portion of the reach shaded by trees; shrub cover refers to the portion of the shoreline that has shrubs.

Table 15. Area of brook trout habitat by reach, stream class, habitat rank, and life stage, South Branch of the Dead River.

Reach	Stream class	Habitat rank	Life stage: Adult ft.²	Adult 100 yd.²	Juvenile ft.²	Juvenile 100 yd.²
1	C4	0.6	0	0	189,000	210
		0.7	189,000	210	604,500	672
		0.8	604,500	672	23,888	27
		0.9	71,736	80	0	0
		All	**865,236**	**962**	**866,198**	**909**
2	B4	0.6			107,892	120
		0.7	324,000	360	327,230	364
		0.8	224,000	249	18,065	20
		0.9	310,000	344	0	0
		1.0	54,250	60	0	0
		All	**912,250**	**1,013**	**453,187**	**504**
3	C3	0.7	358,540	398	227,405	253
		0.8	172,000	191	323,616	360
		0.9	166,380	185	0	0
		All	**696,920**	**774**	**551,021**	**613**
4	E5	0.3	0	0	157,642	175
		0.4	0	0	27,972	31
		0.6	724,300	805	0	0
		0.7	694,900	772	446,654	496
		0.8	997,550	1,108	477,729	531
		All	**2,416,750**	**2,685**	**1,109,997**	**1,233**
5	F6	0.3	0	0	266,234	29.6
		0.4	0	0	0	0
		0.5	0	0	0	0
		0.6	976,500	1,085	0	0
		0.7	900,000	1,000	401,842	446
		0.8	282,900	314	169,064	188
		All	**2,159,400**	**2,399**	**570,906**	**634**
6	C5	0.3			584,187	649
		0.4	123,500	137	683,044	759
		0.5	315,510	351	325,212	361
		0.6	1,983,683	2,204	135,601	151
		0.7	1,688,310	1,876	0	0
		0.8	143,500	159	98,069	109
		All	**4,254,503**	**4,727**	**1,826,113**	**2,029**
7	B4	0.3			2,833,688	3,149
		0.4	2,013,300	2,237	2,792,541	3,103
		0.5	3,253,492	3,615	0	0
		0.6	3,315,440	3,684	2,745,935	3,051
		0.7	4,972,310	5,525	564,695	627
		0.8	1,997,025	2,219	250,000	278
		0.9	565,000	628	0	0
		All	**16,116,567**	**17,908**	**9,186,859**	**10,208**

Table 15. Brook trout habitat (ft. ²) by reach, stream class, habitat rank, and life stage, South Branch of the Dead River (con't).

Reach	Stream class	Habitat rank	Life stage: Adult ft.²	Adult 100 yd.²	Juvenile ft.²	Juvenile 100 yd.²
8	F4	0.3			3,308,116	3,676
		0.4	3,308,116	3,676	3,055,025	3,394
		0.5	6,618,905	7,354	139,150	155
		0.6	8,715,179	9,684	6,677,150	7,419
		0.7	19,117,120	21,241	0	0
		0.8	4,558,100	5,065	0	0
		All	**42,317,420**	**47,020**	**13,179,441**	**14,644**
9	B4	0.3	0	0	920,595	1,023
		0.4	0	0	1,391,646	1,546
		0.5	904,400	1,005		
		0.6	3,534,150	3,927	1,736,895	1,930
		0.7	2,691,500	2,991	0	0
		0.8	3,218,000	3,576	0	0
		All	**10,348,050**	**11,499**	**4,049,136**	**4,499**
All	All	**0.3**	**0**	**0**	**8,070,462**	**8,967**
		0.4	**5,444,916**	**6,050**	**7,950,228**	**8,834**
		0.5	**11,092,307**	**12,325**	**464,352**	**516**
		0.6	**19,249,252**	**21,388**	**11,592,473**	**12,880**
		0.7	**30,935,680**	**34,373**	**2,572,326**	**2,858**
		0.8	**12,197,575**	**13,553**	**1,360,431**	**1,512**
		0.9	**1,113,116**	**1,237**	**0**	**0**
		1.0	**54,250**	**60**	**0**	**0**
		All	**80,087,096**	**88,986**	**32,010,272**	**35,567**

Table 16. Area (100 yd²) and (percent of class) of **adult** brook trout habitat, South Branch of the Dead River, by HSI values and reach.

Reach	Stream class	Habitat Suitability Index 0.4	0.5	0.6	0.7	0.8	0.9	1.0	All
1	C4				210	672	80		**962**
					(22)	(70)	(8)		
2	B4				360	249	344	60	**1,013**
					(36)	(25)	(34)	(6)	
3	C3				398	191	185		**774**
					(51)	(25)	(24)		
4	E5			805	772	1,108			**2,685**
				(30)	(29)	(41)			
5	F6			1,085	1,000	314			**2,399**
				(45)	(42)	(13)			
6	C5	137	351	2,204	1,876	159			**4,727**
		(3)	(7)	(47)	(40)	(3)			
7	B4	2,237	3,615	3,684	5,525	2,219	628		**17,908**
		(12)	(20)	(21)	(31)	(12)	(4)		
8	F4	3,676	7,354	9,684	21,241	5,065			**47,020**
		(8)	(16)	(21)	(45)	(11)			
9	B4		1,005	3,927	2,991	3,576			**11,499**
			(9)	(34)	(26)	(31)			
All		**6,050**	**12,325**	**21,389**	**34,373**	**13,553**	**1,237**	**60**	**88,987**
		(7)	**(14)**	**(24)**	**(39)**	**(15)**	**(1)**	**(1)**	

Table 17. Area (100 yd²) and (percent of total) of **juvenile** brook trout habitat, South Branch of the Dead River, by HSI values and reach.

Reach	Stream class	Habitat Suitability Index 0.3	0.4	0.5	0.6	0.7	0.8	All
1	C4				210	672	27	**909**
					(23)	(74)	(3)	
2	B4				120	364	20	**504**
					(24)	(72)	(4)	
3	C3					253	359	**612**
						(41)	(59)	
4	E5	175	31			497	531	**1,234**
		(14)	(3)			(40)	(43)	
5	F6	296				447	188	**931**
		(32)				(48)	(20)	
6	C5	649	759	361	151		109	**2,029**
		(32)	(37)	(18)	(7)		(5)	
7	B4	3,149	3,103		3,051	628	278	**10,209**
		(31)	(30)		(30)	(6)	(3)	
8	F4	7,638	4,637	296	9,130	2,423	1,301	**25,425**
		(30)	(18)	(1)	(36)	(10)	(5)	
9	B4	1,023	1,546		1,930			**4,499**
		(23)	(34)		(43)			
All		**12,930**	**10,076**	**657**	**14,592**	**5,284**	**2,813**	**46,352**
		(28)	**(22)**	**(1)**	**(31)**	**(11)**	**(6)**	

Table 18. Location and quantity of spawning-size substrate, South Branch of the Dead River.

Reach	Stream class	Transect no.	Stream mile	Quantity ft.²	Quantity 100 ft.²	Landmark
3	C3	16	21.0	183,680	204	Redington Road
4	E5	20	20.8	70,000	78	
5	F6	42	19.4	224,800	250	
6	C5	48	18.9	143,500	159	
		49	18.8	151,000	168	
		56	18.4	154,385	172	Near Rt. 16
		57	18.3	71,685	80	
		58	18.3	74,496	83	
		59	18.2	215,400	239	
		All		**810,466**	**901**	
7	B4	93	14.8	255,000	283	Near Langtown line
		94	14.7	600,000	667	
		107	13.4	447,500	497	
		108	13.3	140,220	156	
		All		**1,442,720**	**1,603**	
8	F4	121	12.3	119,757	133	
		122	12.3	137,671	153	
		123	12.2	68,310	76	
		124	12.2	1,079,635	1,200	
		125	12.1	352,185	391	
		128	11.6	497,800	553	
		136	10.6	238,750	265	Upstream of oxbow
		137	10.5	192,000	213	
		138	10.5	275,200	306	
		141	10.3	314,000	349	
		142	10.2	242,000	269	
		154	8.8	299,520	333	
		156	8.6	248,580	276	
		164	7.6	379,800	422	Upstream of Langtown br.
		188	5.2	859,580	955	
		192	4.5	850,000	944	
		All		**6,154,788**	**6,839**	

Table 19. Stream stability (Pfankuch) evaluation.

Reach	River mile	Stream type	Pfankuch rating	Reach condition
1	23.0	C3	61	Good
2	22.6	B3c	71	Fair
3	21.8	C3	48	Excellent
4	21.6	E5	47	Excellent
5	20.1	F6	140	Poor
6	15.7	B4	97	Poor
7	11.3	F5	103	Good

Table 20. Summary of sensitivity-to-disturbance indices, South Branch Dead River, by 100 yd^2 and (percent).

	Category					
Index	Extreme	Very high	High	Moderate	Low	Very low
Sensitivity to disturbances	47,019 (53)	10,772 (12)		31,193 (35)		
Streambank erosion potential		54,145 (61)	3,647 (4)	774 (1)	30,419 (34)	
Sediment supply		51,746 (58)	3,360 (4)	33,878 (38)		

Table 21. Fish species present within the South Branch of the Dead River drainage.

Water	Species[6]															
	BKT	BND	CCB	CMS	FHM	FLF	FSD	LCB	**LLS**	LNS	PRD	PKL	RBD	SCL	SLT	WHS
South Branch Dead River																
Langtown Bridge	**X**	X		X										X		
Lang/Dallas line		X		X										X		
Tributaries																
Cold Brook	**X**		X													
Redington Stream	**X**	X			X									X		
Greely Pond Outlet		X	X		X						X		X	X		
Quill Pond Outlet	**X**	X												X		
Baker Brook	**X**	X	X		X	X							X			
Nash Stream	**X**	X								X				X		
Lakes and Ponds																
Flagstaff Lake	**X**	X	X	X		X	X	X	**X**		X	X		X	X	X
Saddleback Lake	**X**	X	X	X					**X**		X	X	X			X
Loon Lake	**X**	X	X	X			X			X	X		X		X	X
Cow Pond	**X**	X	X										X		X	X
Greely Pond	**X**	X	X	X			X		**X**							X
Greely Pond, Little	**X**		X				X									X

[6] BKT = brook trout; BND = Blacknose dace; CCB = creek chub; CMS = common shiner; FHM = fathead minnow; FLF = fallfish; FSD = finescale dace; LCB = lake chub; LLS = landlocked salmon; LNS = longnose sucker; NRD = northern redbelly dace; PKL=chain pickerel; PRD = pearl dace; RBD = redbelly dace; SCL = sculpin; SLT = smelt; WHS = white sucker.

Appendix 1 Transect summary, South Branch of the Dead River survey, 2003.

Survey section	Reach	Transect number	Length (feet)	River mile	Flow type	Comments/spawning
				22.9	Deadwater	Lake influence
1	1	1	500	22.4	Riffle	Begin at bridge
1	1	2	500	22.3	Riffle	Water 64° at 10:50
1	1	3	500	22.2	Riffle	
1	1	4	392	22.1	Riffle	
1	1	5	500	22.0	Cascade	
1	1	6	500	21.9	Cascade	
1	2	7	500	21.8	Cascade	Mass wasting left bank, 150'
1	2	8	175	21.7	Cascade	
1	2	9	500	21.7	Riffle	
1	2	10	900	21.6	Cascade	
1	2	11	800	21.4	Riffle	
1	3	12	705	21.3	Riffle	
1	3	13	430	21.2	Riffle	
1	3	14	350	21.1	Riffle	
1	3	15	154	21.0	Run	
1	3	16	574	21.0	Riffle	Redington Road
2	4	17	0	20.9	Run	
2	4	18	250	20.9	Riffle	
2	4	19	250	20.8	Run	
2	4	20	250	20.8	Run	Beaver dam, 6-8" drop
2	4	21	300	20.7	Run	
2	4	22	300	20.7	Run	
2	4	23	300	20.6	Run	
2	4	24	300	20.5	Run	Beaver dam, 1' drop
2	4	25	300	20.5	Run	
2	4	26	300	20.4	Run	Beaver dam, 4" drop
2	4	27	300	20.3	Run	
2	4	28	300	20.3	Run	
2	4	29	300	20.2	Run	
2	4	30	300	20.2	Run	Beaver dam, 1' drop
2	4	31	300	20.1	Run	
2	4	32	300	20.1	Run	Old railroad bridge
2	4	33	500	20.0	Run	
2	4	34	500	19.9	Deadwater	
2	4	35	550	19.8	Deadwater	
2	4	36	300	19.7	Riffle	Flagg Dam, no head
2	4	37	300	19.7	Riffle	
2	5	38	300	19.6	Run	
2	5	39	300	19.5	Riffle	
2	5	40	300	19.5	Riffle	
2	5	41	300	19.4	Riffle	Ledge, 1' drop
2	5	42	400	19.4	Run	
2	5	43	400	19.3	Run	Shale, gravel
2	5	44	300	19.2	Run	
2	5	45	500	19.2	Run	End camp road, ATV trail
2	5	46	500	19.1	Run	
2	5	47	500	19.0	Deadwater	
2	6	48	500	18.9	Run	Beaver dam, 1.5' drop
2	6	49	500	18.8	Run	Rt. 16 bridge

Appendix 1. Transect summary, South Branch of the Dead River survey, 2003 (con't)

Survey section	Reach	Transect number	Length (feet)	River mile	Flow type	Comments/spawning
3	6	50	0	18.7	Run	
3	6	51	282	18.7	Run	
3	6	52	369	18.6	Run	
3	6	53	200	18.6	Run	
3	6	54	200	18.5	Run	
3	6	55	345	18.5	Run	
3	6	56	550	18.4	Run	Rt. 16 near bank
3	6	57	295	18.3	Run	Small beaver dam
3	6	58	194	18.3	Run	
3	6	59	600	18.2	Run	
3	6	60	335	18.1	Run	
3	6	61	250	18.0	Run	
3	6	62	345	18.0	Run	
3	6	63	625	17.9	Run	
3	6	64	920	17.8	Run	
3	6	65	540	17.6	Run	
3	6	66	1,150	17.5	Run	
3	6	67	500	17.3	Run	
3	6	68	190	17.2	Riffle	
3	6	69	430	17.2	Riffle	
3	7	70	900	17.1	Run	
3	7	71	900	16.9	Cascade	Fansanger Falls
3	7	72	500	16.8	Cascade	Gorge
3	7	73	325	16.7	Riffle	
3	7	74	345	16.6	Riffle	Greeley P road bridge site
4	7	75	0	16.5	Run	
4	7	76	400	16.5	Pool	
4	7	77	400	16.5	Rapids	
4	7	78	400	16.4	Run	
4	7	79	706	16.3	Deadwter	
4	7	80	444	16.2	Run	
4	7	81	450	16.1	Rapids	
4	7	82	488	16.0	Cascade	
4	7	83	324	15.9	Cascade	
4	7	84	388	15.9	Run	
4	7	85	800	15.8	Riffle	
4	7	86	738	15.6	Riffle	
4	7	87	762	15.5	Riffle	
4	7	88	705	15.4	Run	
4	7	89	510	15.2	Riffle	Langtown line
5	7	90	804	15.1	Run	
5	7	91	500	15.0	Riffle	
5	7	92	500	14.9	Riffle	
5	7	93	500	14.8	Run	
5	7	94	500	14.7	Riffle	
5	7	95	500	14.6	Riffle	Elevation change
5	7	96	500	14.5	Pool	Seep, 45°
5	7	97	500	14.4	Pool	
5	7	98	500	14.3	Run	

Appendix 1. Transect summary, South Branch of the Dead River survey, 2003 (con't)

Survey section	Reach	Transect number	Length (feet)	River mile	Flow type	Comments/spawning
5	7	99	500	14.2	Riffle	
5	7	100	500	14.1	Riffle	
5	7	101	500	14.0	Run	
5	7	102	500	13.9	Run	Seep
5	7	103	500	13.8	Run	Gravel pit road bridge
6	7	104	871	13.7	Pool	
6	7	105	400	13.6	Run	
6	7	106	400	13.5	Run	
6	7	107	500	13.4	Run	
6	7	108	246	13.3	Run	
6	7	109	525	13.3	Run	
6	7	110	500	13.2	Run	
6	7	111	430	13.1	Run	
6	7	112	500	13.0	Run	
6	7	113	500	12.9	Run	
6	7	114	500	12.8	Run	Log abutment
6	7	115	475	12.7	Riffle	
6	7	116	760	12.6	Run	
6	7	117	335	12.5	Riffle	Langtown Mill bridge
7	8	118	234	12.4	Run	
7	8	119	322	12.4	Run	
7	8	120	157	12.3	Riffle	
7	8	121	207	12.3	Run	
7	8	122	275	12.3	Riffle	
7	8	123	165	12.2	Run	
7	8	124	575	12.2	Run	Undercut banks
7	8	125	720	12.1	Run	Dam remains?
7	8	126	920	11.9	Run	
7	8	127	581	11.8	Riffle	
7	8	128	950	11.6	Run	
7	8	129	804	11.5	Run	
7	8	130	705	11.3	Deadwater	
7	8	131	734	11.2	Run	Dam remains?
7	8	132	950	11.0	Run	Split channel
7	8	133	440	10.9	Riffle	
7	8	134	575	10.8	Riffle	Rt. 16 near river near oxbow
8	8	135	356	10.7	Run	
8	8	136	250	10.6	Run	
8	8	137	400	10.5	Riffle	Oxbow
8	8	138	400	10.5	Riffle	
8	8	139	400	10.4	Run	
8	8	140	300	10.3	Run	
8	8	141	400	10.3	Run	
8	8	142	400	10.2	Riffle	Woody debris
8	8	143	400	10.1	Run	
8	8	144	400	10.0	Run	Camp
8	8	145	800	10.0	Run	
8	8	146	800	9.8	Run	
8	8	147	900	9.7	Run	Saw 7" brook trout

Appendix 1. Transect summary, South Branch of the Dead River survey, 2003 (con't).

Survey section	Reach	Transect number	Length (feet)	River mile	Flow type	Comments/spawning
8	8	148	800	9.5	Run	
8	8	149	800	9.3	Run	Beaver dam, 1' drop
9	8	150	800	9.2	Run	Howatt trail
9	8	151	151	9.0	Run	
9	8	152	600	9.0	Run	
9	8	153	600	8.9	Riffle	
9	8	154	600	8.8	Run	7" dead brook trout
9	8	155	600	8.7	Run	
9	8	156	600	8.6	Run	
9	8	157	600	8.4	Pool	
9	8	158	600	8.3	Run	
9	8	159	600	8.2	Run	
9	8	160	600	8.1	Run	
9	8	161	600	8.0	Run	
9	8	162	600	7.9	Riffle	
9	8	163	600	7.8	Run	
9	8	164	600	7.6	Run	
10	8	165	0	7.5	Run	Langtown bridge
10	8	166	500	7.5	Pool	
10	8	167	500	7.4	Run	
10	8	168	500	7.3	Run	
10	8	169	500	7.2	Run	
10	8	170	500	7.1	Run	
10	8	171	500	7.1	Riffle	
10	8	172	500	7.0	Run	
10	8	173	500	6.9	Pool	
10	8	174	500	6.7	Run	
10	8	175	500	6.7	Run	
10	8	176	500	6.6	Run	
10	8	177	500	6.5	Pool	
10	8	178	500	6.4	Pool	
10	8	179	500	6.3	Pool	
10	8	180	500	6.2	Pool	
10	8	181	500	6.1	Run	
10	8	182	500	6.0	Run	
11	8	183	0	6.0	Pool	Bourque Road
11	8	184	500	5.9	Riffle	
11	8	185	1,000	5.7	Run	
11	8	186	1,000	5.5	Riffle	
11	8	187	800	5.4	Riffle	
11	8	188	1,000	5.2	Riffle	
11	8	189	1,000	5.0	Run	
11	8	190	600	4.9	Run	Beaver dam, 1' drop
11	8	191	1,000	4.7	Riffle	
11	8	192	1,000	4.5	Run	
11	8	193	1,000	4.3	Run	Trib 57°
11	8	194	1,000	4.1	Riffle	Beaver dam, 6" drop
11	8	195	900	4.0	Riffle	
11	8	196	1,000	3.8	Riffle	

Appendix 1. Transect summary, South Branch of the Dead River survey, 2003 (con't).

Survey section	Reach	Transect number	Length (feet)	River mile	Flow type	Comments/spawning
11	8	197	1,000	3.6	Riffle	Ledge, 2' drop
11	8	198	1,000	3.4	Riffle	Trib 56°
11	8	199	1,000	3.2	Riffle	
11	8	200	425	3.1	Riffle	Lutton Brk section
12	8	201	500	3.0	Riffle	
12	8	202	560	2.9	Riffle	
12	8	203	340	2.9	Pool	
12	8	204	280	2.8	Run	
12	8	205	530	2.7	Riffle	Lutton Brk 61°, good flow
12	8	206	210	2.7	Run	
12	8	207	675	2.5	Riffle	
12	8	208	1,000	2.4	Run	Nash Stream 73°
12	8	209	362	2.3	Run	
12	8	210	606	2.2	Riffle	
13	9	211	0	2.2	Riffle	Barn Doors/Snowmobile Br.
13	9	212	650	2.0	Riffle	
13	9	213	450	2.0	Run	
13	9	214	600	1.8	Run	
13	9	215	800	1.7	Riffle	Algae present
13	9	216	900	1.5	Riffle	0.5 above Flagstaff Lake
13	9	217	800	1.4	Riffle	
13	9	218	800	1.2	Riffle	
13	9	219	800	1.1	Riffle	
13	9	220	740	0.9	Pool	
13	9	221	760	0.8	Riffle	
13	9	222	1,062	0.6	Run	
13	9	223	458	0.5	Deadwater	
				0	Deadwater	Lake influence

Appendix 2. Description of level I stream types from Rosgen Stream Classification, 1996.

Stream type	Gradient	Profile	Pool spacing	Entrenchment	Width/depth ratio	Sinuosity
Aa+	>0.10	Very steep	n/a	<1.4	<12	1.0-1.1
A	0.04-0.10	Cascades or step pools	2-3	<1.4	<12	1.0-1.2
B	0.2-0.39	Riffle, rapids	4-5	1.4-2.2	>12	>1.2
C	<0.02	Riffle/pool, point bars	5-7	>2.2; well defined floodplain	>12	>1.4
D	<0.04	Braided; eroding banks	n/a		>40	n/a
E	<0.02	Broad meadow valleys	n/a	>2.2	<12	>1.5
F	<0.02	Entrenched, meandering, riffle/pool	n/a	<1.4	>12	>1.4
G	0.2 to 0.39	Entrenched gully	n/a	<1.4	<12	>1.2

Appendix 3. Description of level II stream types from Rosgen Stream Classification, 1996.

Numeric value	1	2	3	4	5	6
Channel material	bedrock	boulders	cobble	gravel	sand	silt/clay

Appendix 4. Pool description by class.

Class	Description
1	Large, deep, good cover. Pool depth and size are sufficient to provide low velocity resting area for several adult fish. More than 30% of the bottom area is obscured by depth, surface turbulence, or structure (instream or overhanging) or maximum pool depth is 5 ft. in streams 16 ft wide. or less; 6.5 ft. in streams greater than 16 ft. wide.
2	Intermediate size, depth, or cover. Pool depth and size are sufficient to provide low velocity resting area for a few adult fish. From 5 to 30% of the bottom area is obscured by depth, surface turbulence, or structure. Typical Class 2 pools are large eddies behind boulders and low-velocity, moderately deep areas beneath undercut banks and overhanging vegetation.
3	Small and/or shallow; poor cover. Pool depth and size are sufficient to provide low velocity resting area for only one or two adult fish. Cover, if present, is limited and the entire bottom is discernible. Typical Class 3 pools are small eddies behind structures and shallow lateral pools.

Appendix 5. South Branch of the Dead River pool numbers, frequency and area by reach.

Reach	Pool class	River mile	Area				Percent of total area	Max. depth (ft.)
			Number	ft.²	100 yd²	acres		
1	A	22.3		5,124	5.7	0.1	0.6	6.5
	C	22.4		754	0.8			2.4
		22.4		1,148	1.3			2.2
		22.2		646	0.7			2.8
		22.2		294	0.3			2.1
		22.1		493	0.5			3.7
		22.0		336	0.4			2.4
		All	**6**	**3,671**	**4.1**	**0.1**	**0.4**	**2.6**
	All		**7**	**8,795**	**9.8**	**0.2**	**1.0**	**3.2**
2	C	21.8		128	0.1			2.9
		21.6		308	0.3			2.3
		21.6		192	0.2			2.7
		21.4		190	0.2			3.0
		All	**4**	**818**	**0.9**	**0.01**	**0.1**	**2.7**
4	A	19.8	1	1,225	1.4	0.03	0.05	4.1
6	A	18.7		12,126	13.5			5.5
		18.5		10,005	11.2			5.1
		18.3		5,900	6.6			5.0
		17.8		27,600	30.7			6.8
		17.6		17,280	19.2			5.3
		17.5		36,000	40.0			6.6
		17.5		10,100	11.2			6.6
		All	**7**	**119,071**	**132.4**	**2.7**	**0.5**	**5.8**
	B	18.4		12,650	14.1			2.8
		17.2		7,865	8.7			3.1
		All	**2**	**20,515**	**22.8**	**0.5**		**3.0**
	C	18.6		11,808	13.1			2.3
		18.6		5,800	6.4			1.7
		18.5		7,400	8.2			4.3
		18.3		.				.
		18.1		8,040	8.9			3.8
		18.0		7,000	7.8			3.7
		18.0		8,280	9.2			3.8
		17.9		18,750	20.8			4.6
		17.3		21,000	23.3			4.3
		All	**9**	**88,078**	**97.9**	**2.0**	**2.1**	**3.6**
	All		**18**	**227,664**	**167.9**	**5.2**		
7	A	17.1		54,000	60.0			7.0
		16.9		44,100	49.0			6.6
		16.8		15,000	16.7			5.6
		16.5		294,525	327.3			7.0
		16.4		193,336	214.8			7.0
		16.1		75,430	83.8			7.0

Appendix 5. South Branch of the Dead River pool numbers, frequency and area by reach (con't).

Reach	Pool class	River mile	Area				Percent of total area	Max. depth (ft.)
			Number	ft.²	100 yd²	acres		
7 (con't.)		13.5		6,161	6.8			8.0
		All	**7**	**682,552**	**758.4**	**15.7**	**4.2**	**3.6**
	B	16.7		8,925	9.9			3.5
		16.4		36,300	40.3			2.1
		16.4		35,000	38.9			2.2
		16.2		25,900	28.8			2.6
		16.2		8,694	9.7			2.9
		16.2		17,170	19.1			2.4
		16.0		55,950	62.2			2.2
		15.8		121,500	135.0			2.8
		15.2		24,102	26.8			2.8
		14.9		7,030	7.8			4.0
		14.6		8,360	9.3			4.7
		14.2		2,688	3.0			3.8
		14.0		5,880	6.5			4.2
		13.5		2,680	3.0			4.2
		13.2		11,700	13.0			3.9
		All	**15**	**371,879**	**413.2**	**8.5**	**2.3**	**3.2**
	C	16.1		8,925	9.9			2.4
		16.1		47,710	53.0			4.4
		16.1		77,740	53.0			3.3
		15.9		56,340	62.6			2.9
		15.9		35,250	39.2			2.4
		14.3		1,080	1.2			3.0
		13.1		735	0.8			4.5
		12.7		800	0.9			3.6
		All	**8**	**228,580**	**254.0**	**5.2**	**1.4**	**3.3**
	All		**30**	**1,283,011**	**1,425.6**	**29.5**	**8.0**	
8	A	8.9		15,600	17.3			5.4
		8.8		4,800	5.3			5.6
		8.7		3,575	4.0			6.7
		8.6		4,200	4.7			6.7
		8.3		3,120	3.5			6.0
		6.9		9,720	10.8			8.0
		6.0		13,120	14.6			5.2
		3.8		8,775	9.8			5.0
		3.1		3,150	3.5			5.0
		All	**9**	**66,060**	**73.4**	**1.5**	**0.2**	**6.0**
	B	12.3		19,588	21.8			2.8
		12.3		14,787	16.4			2.1
		12.2		81,900	91.0			4.0
		12.2		74,700	83.0			4.4
		12.2		18,050	20.1			4.3
		12.1		27,750	30.8			3.9
		11.9		27,571	30.6			3.7
		7.1		2,000	2.2			5.0

Appendix 5. South Branch of the Dead River pool numbers, frequency and area by reach.

Reach	Pool class	River mile	Area				Percent of total area	Max. depth (ft.)
			Number	ft.²	100 yd²	acres		
8 (con't.)	B	5.2		4,200				4.5
		All	**9**	**270,546**	**300.6**	**6.2**	**0.6**	**3.9**
	C	7.2		1,200	1.3			3.1
		7.2		900	1.0			4.6
		6.7		600	0.7			3.3
		6.6		1,200	1.3			4.6
		6.5		1,200	1.3			3.0
		6.5		1,200	1.3			3.8
		6.2		600	0.7			2.7
		6.1		700	0.8			2.5
		6.0		800	0.9			3.2
		2.9		1,360	1.5			4.0
		2.4		486	0.5			3.2
		All	**11**	**10,246**	**11.4**	**0.2**	**0.02**	**3.5**
	All		**29**	**346,852**	**385.4**	**8.0**	**0.8**	
9	A	2.0		6,552	7.3			8.6
		0.8		6,384	7.1			18.0
		All	**2**	**12,936**	**14.4**	**0.3**	**0.1**	**13.3**
	C	1.5		1,404	1.6			3.0
		1.2		896	1.0			2.7
		0.9		1,944	2.2			3.6
		All	**3**	**4,244**	**4.7**	**0.1**	**0.04**	**3.1**
	All		**5**	**17,180**	**19.1**	**0.4**	**0.2**	
All	**A**		**25**	**886,968**	**985.5**	**20.4**	**47.0**	
	B		**26**	**662,940**	**736.6**	**15.2**	**35.2**	
	C		**43**	**335,637**	**372.9**	**7.7**	**17.8**	
	All		**94**	**1,885,545**	**2,095.0**	**43.3**	**100.0**	

COOPERATIVE

STATE FEDERAL

PROJECT

This report has been funded in part by the Federal Aid in Sport Fish Restoration Program. This is a cooperative effort involving federal and state government agencies. The program is designed to increase sport fishing and boating opportunities through the wise investment of anglers' and boaters' tax dollars in state sport fishery projects. This program which was funded in 1950 was named the Dingell-Johnson Act in recognition of the congressmen who spearheaded this effort. In 1984 this act was amended through the Wallop-Breaux Amendment (also named for the congressional sponsors) and provided a threefold increase in Federal monies for sportfish restoration, aquatic education and motorboat access.

The Program is an outstanding example of a "user pays-user benefits", or "user fee" program. In this case, anglers and boaters are the users. Briefly, anglers and boaters are responsible for payment of fishing tackle excise taxes, motorboat fuel taxes, and import duties on tackle and boats. These monies are collected by the sport fishing industry, deposited in the Department of Treasury, and are allocated the year following collection to state fishery agencies for sport fisheries and boating access projects. Generally, each project must be evaluated and approved by the U.S. Fish and Wildlife Service (USFWS). The benefits provided by these projects to users complete the cycle between "user pays — user benefits".

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